## Crochet Disc

## Introduction

How many stitches should there be in each round of crochet to produce a flat disc?
There are many web sites on the Internet which give details for a specific size disc made with a specific size of wool, hook and tension, but there seems to be nothing of a general nature.

It is clear that the number of stitches will depend on the number of stitches per mm, the height of each round and the diameter of the disc.
With this information, a formula can be produced for the number of stitches per round and its derivation is given under the Theory heading.
If $\quad \mathrm{R}=$ radius of the disc, mm
$\mathrm{w}=$ width of a stitch, mm
$\mathrm{h}=$ height of a stitch, mm
and $\mathrm{n}=$ the round number
then the number of stitches in each round $=\frac{2 \pi n h}{w}$
The width of a stitch, w and the height of a stitch, h are found by making a test square of fabric. This should be at least 15 stitches by 15 rows to be reasonably accurate.

Making the calculations directly is tedious and so a web page calculator has been created to do this.
http://www.ikes.16mb.com/physproj/Disc crochet.htm
The calculator also suggests a suitable pattern for creating the disc, which aims to produce the best 'circle' possible by evenly distributing the increases throughout each round.

## Abbreviations.

The crochet patterns use the English notation.
inc $=$ increase is made by making two stitches into the same stitch.
rnd $=$ round
$\times \quad=\quad$ repeat so many times
e.g. ( 1 st, inc) $\times 6$ means (crochet 1 stitch, then make 2 stitches in the next stitch) and repeat this 6 times in total.
ss $=\quad$ slip stitch
st $\quad=\quad$ stitch. The type of stitch is not specified and will depend on what was used to form the tension sample.
loop method $=$ This is used for the first round.
Make a loop of yarn, with the tail hanging downwards and the working yarn overlapping in front of the tail. Holding the loop in place, insert the hook through the centre of the loop and pull the working yarn through the loop.
Make chain(s). Work the requires number of stitches into the loop and then pull the loop tight to complete the first round.
FO Finish off, by cutting the yarn leaving a tail for sewing in and then pulling through the last stitch.

It will be found helpful to mark the beginning of each round with a piece of different coloured yarn. This makes it easier to correct any miscounting of stitches that may occur.

## Examples <br> One

To test the calculator, a tension sample of 20 rows by 20 stitches was made. The yarn was double knit with a 4.5 mm hook and double crochet stitches.


The sample measured 108 mm wide and 85 mm high.
This information was put into the calculator along with a disc diameter of 100 mm .

| Round | Suggested pattern | Stitches | Diameter mm |
| :---: | :---: | :---: | :---: |
| Round 1 | Create a ring of 5 stitches using the loop method. | 5 stitches | 9 mm |
| Round 2 | (inc) $\times 5$ | 10 stitches | 17 mm |
| Round 3 | (1st, inc) $\times 5$ | 15 stitches | 26 mm |
| Round 4 | (1st, inc, 1 st ) $\times 5$ | 20 stitches | 34 mm |
| Round 5 | (3st, inc) $\times 5$ | 25 stitches | 43 mm |
| Round 6 | (2st, inc, 2 st ) $\times 5$ | 30 stitches | 51 mm |
| Round 7 | ( 5 st , inc) $\times 5$ | 35 stitches | 60 mm |
| Round 8 | (3st, inc, 3 st) $\times 5$ | 40 stitches | 68 mm |
| Round 9 | (7st, inc) $\times 5$ | 45 stitches | 77 mm |
| Round 10 | ( 5 st , inc, 5 st ) $\times 4$, 1st | 49 stitches | 85 mm |
| Round 11 | (11st, inc) $\times 2,1 \mathrm{st}$, (11st, inc $) \times 2,1 \mathrm{st}$ | 54 stitches | 94 mm |
| Round 12 | (6st, inc, 6 st$) \times 2,1 \mathrm{st},(6 \mathrm{st}$, inc , 6 st$) \times 2,2 \mathrm{st}$ | 59 stitches | 102 mm |

The pattern above produced a disc with an diameter of approximately 105 mm .
To finish the disc, it would have been worth making a slip stitch before finishing off in order to make the last round into more of a circle.
The disc in the photo did not have to be pressed to make it flat, which suggests that the theory used in the calculator is reasonably accurate.


Although the suggested pattern has distributed the increases around the disc, they can still just be seen, giving a 10 sided disc (polygon). If the increases are not distributed, then a pentagon is produced.


## Two

For the next test of the calculator, another tension sample of 20 rows by 20 stitches was made. The yarn was again double knit with a 4.5 mm hook but this time triple crochet stitches.


The sample measured 120 mm wide and 191 mm high.
This information was put into the calculator along with a disc diameter of 135 mm .

| Round | Suggested pattern | Stitches | Diameter mm |
| :--- | :--- | :--- | :--- |
| Round 1 | Create a ring of 10 stitches using the loop method. | 10 stitches | 19 mm |
| Round 2 | (inc $) \times 10$ | 20 stitches | 38 mm |
| Round 3 | $(1 \mathrm{st}, \mathrm{inc}) \times 10$ | 30 stitches | 57 mm |
| Round 4 | $(1 \mathrm{st}, \mathrm{inc}, 1 \mathrm{st}) \times 10$ | 40 stitches | 76 mm |
| Round 5 | $(3 \mathrm{st}$, inc $) \times 10$ | 50 stitches | 96 mm |
| Round 6 | $(2 \mathrm{st}$, inc, 2 st$) \times 10$ | 60 stitches | 115 mm |
| Round 7 | $(5 \mathrm{st}$, inc $) \times 10$ | 70 stitches | 134 mm |

A stitch in the pattern this time refers to a treble crochet.
The pattern above produced a disc with an diameter of approximately 135 mm .
To finish the disc, it would have been worth making a double crochet and then a slip stitch before finishing off in order to make the last round into more of a circle.
The disc in the photo did not have to be pressed to make it flat, which again suggests that the theory used in the calculator is reasonably accurate.
Since there are more stitches in the initial round (and hence the repeats), there is less sign of the disc being a polygon.


## Theory.

Consider a disc of radius R.
Within the disc, consider row $n$ of radius $r$, where $n$ is the number of rows out from the centre.


If:-
$\mathrm{r}=$ radius of the row
$\mathrm{w}=$ width of a stitch
$\mathrm{h}=$ height of a stitch
and row n has x stitches

Then $=>\mathrm{xw}=2 \pi \mathrm{r}, \quad$ the circumference of the row
But $\mathrm{r}=\mathrm{nh}$,
Combining these together to eliminate r

$$
\begin{aligned}
& \Rightarrow \mathrm{xw}=2 \pi \mathrm{nh} \\
& \Rightarrow \mathrm{x}=\frac{2 \pi \mathrm{nh}}{\mathrm{w}}
\end{aligned}
$$

So the number of stitches in row n is equal to
$2 \pi \mathrm{nh}$ w

